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Amendment to the Claims

In the Claims:

Please cancel Claim 113.

No other amendments are to be made.

1. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates, stacked in layers, each simple plate having at least one opening that extends therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple plate, said simple plates, when thus stacked in layers, defining:

(a) a fluid path for each different chemical reactant;

(b) a fluid path for a chemical product; and

(c) a plurality of individual reaction units providing internal parallelization of fluid flow through the stacked plate reactor, thereby increasing a quantity of chemical product that can be produced by said stacked plate reactor per unit time, each reaction unit including:

(i) a mixing and reaction chamber;

(ii) a reactant fluid path for each reactant, each reactant fluid path being in fluid communication with said mixing and reaction chamber; and

(iii) a bypass fluid path for each reactant, each bypass fluid path being in fluid communication with a different individual reaction unit, such that a reactant flowing in a bypass fluid path in a reaction unit does not also flow into a mixing and reaction chamber in said reaction unit.

2. (Original) The stacked plate reactor of Claim 1, further comprising at least one additional plate having no openings, said at least one additional plate being disposed to seal at least one of a top, a bottom, and a side of the stacked plate reactor

3. (Canceled)

4. (Canceled)

5. (Previously Presented) The stacked plate reactor of Claim 1, wherein a plurality of individual reaction units are irreversibly joined together to form a reactor stack.

6. (Original) The stacked plate reactor of Claim 5, wherein a plurality of individual reactor stacks are reversibly joined together to form a chemical plant.

7. (Previously Presented) The stacked plate reactor of Claim 1, further comprising means for equalizing a residence time distribution within said stacked plate reactor.

8. (Original) The stacked plate reactor of Claim 7, wherein said means for equalizing the residence time distribution within said stacked plate reactor comprises a bifurcated opening in at least one of the

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plurality of simple plates, said bifurcated opening defining at least one of a reactant fluid path and a product fluid path.

9. (Original) The stacked plate reactor of Claim 7, wherein said means for equalizing a residence time distribution within said stacked plate reactor comprises an array of openings in at least one of the plurality of simple plates, said array of openings defining at least one of a plurality of reactant fluid paths, a plurality of mixing and reaction chambers, and a plurality of product fluid paths, said array of openings comprising openings having widths that vary across said array.

10. (Original) The stacked plate reactor of Claim 9, wherein a widest opening in said array is disposed furthest from an opening that enables a fluid to exit from said array.

11. (Original) The stacked plate reactor of Claim 9, wherein a widest opening in said array is disposed closest to an opening that enables a fluid to exit from said array.

12. (Original) The stacked plate reactor of Claim 10, wherein the widths of said array vary as a function of the change of the viscosity of a fluid to be introduced into said array.

13. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates, stacked in layers, each simple plate having at least one opening that extends therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple plate, thereby forming:

(a) a fluid path for each different chemical reactant;

(b) a processing volume in fluid communication with each fluid path for each different chemical reactant;

(c) a fluid path for a chemical product in fluid communication with the processing volume;

(d) a fluid path for a heat transfer medium;

(e) a heat exchanger in fluid communication with the fluid path for the heat transfer medium and disposed so as to moderate a temperature of at least one of a chemical reactant, the processing volume, and the fluid path for the chemical product; and

(f) a plurality of serially connected reaction units providing internal parallelization of fluid flow through the stacked plate reactor, thereby increasing a quantity of chemical product that can be produced by said stacked plate reactor per unit time, each reaction unit including:

(i) a processing volume;

(ii) a reactant fluid path for each reactant, each reactant fluid path being in fluid communication with a processing volume; and

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(iii) a bypass fluid path for each reactant in fluid communication with any subsequent reaction unit, but not in fluid communication with the processing volume of a current reaction unit.

14. (Original) The stacked plate reactor of Claim 13, further comprising at least one additional plate having no openings, said at least one additional plate being disposed to seal at least one of a top, a bottom, and a side of the stacked plate reactor.

15. (Original) The stacked plate reactor of Claim 13, wherein said simple plates comprise a material selected from the group consisting of crystalline wafers, ceramics, glasses, polymers, composite materials, and metals.

16. (Original) The stacked plate reactor of Claim 13, wherein said simple plates are fabricated from a stainless steel.

17. (Canceled)

18. (Canceled)

19. (Previously Presented) The stacked plate reactor of Claim 13, wherein each serially-connected reaction unit comprises:

(a) a first heat exchanger for modifying a temperature of a first chemical reactant; and

(b) a second heat exchanger for modifying a temperature of at least one of a second chemical reactant and of the processing volume.

20. (Original) The stacked plate reactor of Claim 19, wherein a heat exchanger is shared between adjacent serially-connected reaction units.

21. (Previously Presented) The stacked plate reactor of Claim 13, wherein the processing volume of each reaction unit is sandwiched between a pair of heat exchangers.

22. (Previously Presented) The stacked plate reactor of Claim 13, wherein a plurality of individual reaction units are irreversibly joined together to form a reactor stack.

23. (Previously Presented) The stacked plate reactor of Claim 13, wherein a plurality of individual reactor stacks are reversibly joined together to form a chemical plant.

24. (Previously Presented) The stacked plate reactor of Claim 13, wherein each subsequent serially-connected reaction unit is coupled to a subsequent reaction unit such that a first simple plate in a subsequent reaction unit is stacked adjacent to a last simple plate of a preceding reaction unit.

25. (Previously Presented) The stacked plate reactor of Claim 13, wherein the processing volume fluid paths for each reactant are disposed so that laminated flow is established between each reactant flowing in the processing volume.

26. (Previously Presented) The stacked plate reactor of Claim 13, wherein each subsequent serially-connected reaction unit is coupled to a subsequent reaction unit such that a first simple plate of a subsequent reaction unit also represents the last simple plate of a preceding reaction unit.

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27. (Previously Presented) The stacked plate reactor of Claim 13, wherein the processing volume fluid paths for each reactant are disposed so that laminated flow is established between each reactant flowing in the processing volume.

28. (Previously Presented) The stacked plate reactor of Claim 13, wherein the processing volume comprises a plurality of individual mixing and reaction chambers.

29. (Canceled)

30. (Canceled)

31. (Previously Presented) The stacked plate reactor of Claim 13, further comprising a plurality of fluid channels in the heat exchanger that extend substantially orthogonal to a plurality of fluid channels for directing a flow of at least one of a chemical reactant and a chemical product, where a temperature of said one of the chemical product and the chemical reactant is modified by heat transfer relative to the heat transfer medium that is flowing through the heat exchanger, thereby enhancing the quality of a product that is produced in the stacked plate reactor.

32. (Previously Presented) The stacked plate reactor of Claim 13, further comprising fluid paths for each chemical reactant that is disposed so as to establish laminated flow in the processing volume, thereby enhancing the quality of the product that is produced in the stacked plate reactor.

33. (Previously Presented) The stacked plate reactor of Claim 13, further comprising a processing volume simple plate disposed immediately adjacent to a simple plate having an opening defining the processing volume, said processing volume simple plate having a first opening associated with a first fluid path for a first chemical reagent, and a second opening associated with a second fluid path for a second chemical reagent, said first opening and said second opening being aligned with the opening defining the processing volume, such that a first reactant is caused to enter the processing volume, followed by a second reactant in a manner that establishes laminated flow of the first reactant and the second reactant in the processing volume, thereby enhancing the quality of a product that is produced in the stacked plate reactor.

34. (Previously Presented) The stacked plate reactor of Claim 13, further comprising means for equalizing a residence time distribution of a fluid flowing within said reactor.

35. (Original) The stacked plate reactor of Claim 34, wherein said means for equalizing a residence time distribution within said reactor comprises an opening in at least one simple plate, said opening having a bifurcated shape, the bifurcated shape causing a fluid to split into a bifurcated fluid channel having a plurality of branches.

36. (Original) The stacked plate reactor of Claim 35, wherein each chemical reactant flows through a different bifurcated fluid channel, a stem of each bifurcated fluid channel being in fluid communication with a respective chemical reactant inlet, and the branches of each bifurcated fluid channel being in fluid communication with the processing volume.

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37. (Original) The stacked plate reactor of Claim 35, wherein the processing volume comprises a plurality of mixing and reaction chambers, such that one branch from each of the bifurcated fluid channels is in fluid communication with each of the plurality of mixing and reaction chambers.

38. (Original) The stacked plate reactor of Claim 37, wherein the processing volume comprises a plurality of mixing and reaction chambers, further comprising a bifurcated product collection channel having a plurality of branches, a stem of the bifurcated product collection channel being in fluid communication with a chemical product outlet, and each branch of the bifurcated product collection channel being in fluid communication with a different one of the plurality of mixing and reaction chambers.

39. (Original) The stacked plate reactor of Claim 37, wherein a bifurcated fluid channel is included for each chemical reactant and a bifurcated product collection channel is included to collect a product.

40. (Original) The stacked plate reactor of Claim 37, wherein the heat exchanger comprises a first heat exchanger for modifying a temperature of a first chemical reactant, further comprising:

(a) a second heat exchanger for modifying a temperature of at least one of a second chemical reactants and the processing volume;

(b) a third heat exchanger for modifying a temperature of at least one of the processing volumes and a product collection channel; and

(c) a fourth heat exchanger for modifying a temperature of the product collection channel.

41. (Original) The stacked plate reactor of Claim 34, wherein said means for equalizing a residence time distribution within said reactor comprises a bifurcated fluid path having a plurality of branches.

42. (Original) The stacked plate reactor of Claim 41, wherein said bifurcated fluid path is achieved by a bifurcated shaped opening in at least one simple plate, such that the bifurcated fluid path is oriented substantially parallel to an orientation of the simple plates.

43. (Original) The stacked plate reactor of Claim 41, wherein said bifurcated fluid path is achieved by aligning openings in a plurality of adjacent simple plates, such that the bifurcated fluid path is oriented substantially orthogonally to an orientation of the simple plates.

44. (Original) The stacked plate reactor of Claim 41, wherein said bifurcated fluid path is achieved by a combination of a bifurcated shaped opening in at least one simple plate, and by aligning openings in a plurality of adjacent simple plates.

45. (Original) The stacked plate reactor of Claim 37, further comprising:

(a) a first outer simple plate having openings defining a fluid inlet for each different chemical reactant, a fluid inlet for the heat transfer medium, and a fluid outlet for the heat transfer medium; and

(b) a second outer simple plate having an opening defining the chemical product outlet.

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46. (Original) The stacked plate reactor of Claim 37, wherein the processing volume comprises a plurality of parallel mixing and reaction chambers that are disposed between a pair of heat exchangers.

47. (Original) The stacked plate reactor of Claim 34, wherein said means for equalizing a residence time distribution of a fluid comprises a plurality of openings having different widths disposed in at least one simple plate, the different widths being selected to provide a substantially even flow equipartition for a fluid flowing through a plurality of different width fluid channels defined by the plurality of openings having different widths.

48. (Canceled)

49. (Previously Presented) The stacked plate reactor of Claim 117, wherein a widest fluid channel in said parallel array of different width fluid channels is disposed closer to a fluid inlet opening than any other fluid channel in said parallel array.

50. (Previously Presented) The stacked plate reactor of Claim 117, wherein a widest fluid channel in said parallel array of different width fluid channels is disposed further to a fluid outlet opening than any other fluid channel in said parallel array.

51. (Previously Presented) The stacked plate reactor of Claim 117, wherein each chemical reactant is directed into a different parallel array of different width fluid channels.

52. (Previously Presented) The stacked plate reactor of Claim 117, wherein the processing volume comprises a parallel array of different width fluid channels, each different width fluid channel comprising an individual mixing and reaction chamber.

53. (Previously Presented) The stacked plate reactor of Claim 117, wherein the widths of said fluid channels in the array are determined as a function of the viscosity change of a fluid to be introduced into said array.

54. (Previously Presented) The stacked plate reactor of Claim 117, wherein the heat exchanger comprises a first heat exchanger for modifying a temperature of a first chemical reactant, and a second heat exchanger for modifying a temperature of at least one of a second chemical reactant and the processing volume.

55. (Previously Presented) The stacked plate reactor of Claim 117, further comprising one of a top simple plate, a bottom simple plate, and a side simple plate, said one having openings defining a fluid inlet for each different chemical reactant, a fluid inlet for the heat transfer medium, a fluid outlet for the heat transfer medium, and a chemical product outlet.

56. (Previously Presented) The stacked plate reactor of Claim 13, further comprising a plurality of elongate openings in a simple plate that define the heat exchanger, the simple plate being no thicker than about two millimeters, thereby enhancing an efficiency with which the heat exchanger functions to increase a quality of a product produced in said reactor.

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57. (Original) The stacked plate reactor of Claim 13, further comprising at least one plug having a size and shape corresponding to a non-required fluid path defined by aligned openings in said plurality of simple plates, said at least one plug sealing the aligned openings defining said non-required fluid path, thereby eliminating a dead volume in said stacked plate reactor.

58. (Original) The stacked plate reactor of Claim 13, wherein the stack of simple plates are removably held together with an applied compressive force.

59. (Original) The stacked plate reactor of Claim 13, further comprising a housing that applies a compressive force against a top simple plate and a bottom simple plate.

60. (Original) The stacked plate reactor of Claim 13, wherein a mean surface roughness of the simple plates is less than about two micrometers, and the simple plates are substantially free of scratches.

61. (Original) The stacked plate reactor of Claim 13, wherein the simple plates are held together with an applied compressive force, developing a pressure of at least about 300 Newtons per square millimeter.

62. (Original) A simple plate chemical reactor for processing at least two reactants to form a desired chemical product, comprising:

(a) a first outer simple plate comprising a fluid inlet for each different chemical reactant, a fluid outlet for a chemical product, a fluid inlet for a heat transfer medium, and a fluid outlet for a heat transfer medium;

(b) a plurality of internal simple plates defining a plurality of serially-connected reaction units, each reaction unit being in fluid communication with said first outer simple plate, each reaction unit comprising a stack of simple plates, stacked in layers, each simple plate having at least one opening that extends therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple plate, thereby forming:

(i) a plurality of heat exchangers for modifying a temperature of at least one of a chemical reactant and a chemical product;

(ii) at least one mixing and reaction chamber; and

(iii) a bypass fluid path for each reactant, such that a portion of each reactant is diverted from the at least one mixing and reaction chamber of a present reaction unit, and is thus available to be directed to at least one mixing and reaction chamber of a subsequent reaction unit; and

(c) a second outer plate disposed such that the plurality of internal simple plates are stacked between the first outer, simple plate and the second outer plate.

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63. (Original) A simple plate chemical reactor for processing at least two reactants to form a desired chemical product, comprising:

(a) a first outer simple plate comprising a fluid inlet for each different chemical reactant, a fluid outlet for a chemical product, a fluid inlet for a heat transfer medium, and a fluid outlet for a heat transfer medium;

(b) a plurality of internal simple plates defining a plurality of serially-connected reaction units, each reaction unit being in fluid communication with said first simple plate, each reaction unit comprising a stack of simple plates, stacked in layers, each simple plate having at least one opening that extends therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple plate, thereby forming:

(i) a plurality of heat exchangers for modifying a temperature of at least one of a chemical reactant and a chemical product;

(ii) a processing volume;

(iii) a processing fluid path for each reactant, each processing fluid path being in fluid communication with a corresponding reactant fluid inlet and the processing volume;

(iv) a product collection fluid path in fluid communication with the product outlet and the processing volume;

(v) a reactant bypass fluid path for each reactant, each reactant bypass fluid path bypassing the processing volume of a present reaction unit, and being in fluid communication with a different reaction unit; and

(vi) a product bypass fluid path for the reaction product, each product bypass fluid path bypassing the processing volume of a present reaction unit, and being in fluid communication with a different reaction unit; and

(c) a second outer plate disposed such that the plurality of internal simple plates are stacked between the first outer; simple plate and the second outer plate.

64. (Original) The chemical reactor of Claim 63, wherein the simple plates having different configurations are stacked to fabricate the reactor.

65. (Original) The chemical reactor of Claim 63, wherein said second outer plate and said first outer simple plate are identical in configuration, further comprising a plurality of plugs to seal each opening in said second outer plate.

66. (Original) The chemical reactor of Claim 65, further comprising a second simple plate disposed between said first outer simple plate and a first reaction unit, said second simple plate having an opening associated with a product fluid passage.

67. (Original) The stacked plate reactor of Claim 63, further comprising means for enhancing a fluid distribution within said reactor.

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68. (Original) The chemical reactor of Claim 67, wherein said means for enhancing the fluid distribution within the reactor comprises an opening having a bifurcated shape formed in at least one simple plate, for distributing a fluid into a bifurcated channel having a plurality of branches.

69. (Original) The chemical reactor of Claim 68, further comprising a bifurcated fluid channel for each chemical reactant, a stem of each bifurcated fluid channel being in fluid communication with a respective chemical reactant inlet, and branches of each bifurcated fluid channel being in fluid communication with the processing volume.

70. (Original) The chemical reactor of Claim 68, further comprising a bifurcated product collection channel having a plurality of branches, a stem of the bifurcated product collection channel being in fluid communication with the chemical product outlet, and branches of said bifurcated product collection channel being in fluid communication with the processing volume.

71. (Original) The chemical reactor of Claim 68, wherein each reaction unit includes a bifurcated fluid channel and a bifurcated product collection channel.

72. (Original) The chemical reactor of Claim 67, wherein said means for enhancing a fluid distribution within the reactor comprises at least one simple plate in which a plurality of openings having different widths are formed, said different widths being selected to provide a substantially even flow equipartition for a fluid flowing in a plurality of different width fluid channels defined by said plurality of openings.

73. (Original) The chemical reactor of Claim 72, wherein each of the plurality of openings having different widths are disposed in a parallel array, ordered in increasing widths from a narrowest opening to a widest opening, thereby defining a parallel array of different width fluid channels.

74. (Original) The chemical reactor of Claim 73, wherein an incremental increase in the widths of the fluid channels of said array is a function of the viscosity change of a fluid that will flow through the different width fluid channels of said array, so as to equalize a residence time distribution of the fluid within said array.

75. (Original) The chemical reactor of Claim 67, wherein said means for enhancing a fluid distribution within the reactor comprises at least one simple plate in which a plurality of openings having different lengths are formed, said different lengths being selected to provide a substantially equivalent even flow equipartition for a fluid flowing in a plurality of different width fluid channels defined by said plurality of openings.

76. (Previously Presented) A simple plate chemical reactor for processing at least two reactants to form a desired chemical product, comprising:

(a) a first outer simple plate and a second outer simple plate, said first and second outer plates together including a fluid inlet for each chemical reactant, a product outlet, a fluid inlet for a heat transfer medium, and a fluid outlet for the heat transfer medium;

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(b) a plurality of simple plates disposed between the first and the second outer simple plates, each simple plate having at least one opening that extends therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple plate, thereby forming:

(i) a plurality of heat exchangers for modifying a temperature of at least one of a chemical reactant and a chemical product;

(ii) at least one fluid path for each chemical reactant;

(iii) at least one mixing and reaction channel; and

(iv) at least one of:

(1) at least one bifurcated fluid channel configured to enhance a fluid distribution within the reactor, wherein the at least one bifurcated fluid channel comprises an opening in at least one simple plate; and

(2) a plurality of openings having different widths formed in at least one simple plate, said different widths having been selected to provide a substantially even flow equipartition for a fluid flowing in a plurality of fluid channels defined by the plurality of openings having different widths, wherein each of the plurality of openings having different widths in a single simple plate comprise a parallel array, ordered from a narrowest opening, incrementally increasing to a widest opening, defining a parallel array of the plurality of fluid channels having different widths.

77. (Original) The simple plate chemical reactor of Claim 76, wherein the product outlet is disposed in said first outer simple plate.

78. (Original) The simple plate chemical reactor of Claim 76, wherein the product outlet is disposed in said second outer plate.

79. (Previously Presented) The simple plate chemical reactor of Claim 76, further comprising a plurality of openings in a simple plate defining a heat exchanger, and a plurality of openings in an adjacent simple plate defining at least one of a fluid path for a chemical reactant and a mixing and reaction channel, such that the plurality of openings in the simple plate defining the heat exchanger are substantially orthogonal to the plurality of openings in said adjacent simple plate.

80. (Previously Presented) The simple plate chemical reactor of Claim 76, further comprising means for enabling diffusion mixing to occur between at least a first reactant and a second reactant within the simple plate chemical reactor.

81. (Original) The simple plate chemical reactor of Claim 80, wherein said means for enabling diffusion mixing to occur comprises an upper reaction channel simple plate disposed adjacent to a simple plate having an opening defining a mixing and reaction channel, said upper reaction channel simple plate having a first opening associated with a first fluid path for a first chemical reagent, and a second opening associated with a second fluid path for a second chemical reagent, said first opening and said second opening being aligned with the opening defining a mixing and reaction channel, such that a first reactant is

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caused to enter the mixing and reaction channel first, followed by a second reactant, establishing laminated flow between the first reactant and the second reactant in the mixing and reactant channel.

82. (Canceled)

83. (Canceled)

84. (Previously Presented) The simple plate chemical reactor of Claim 76, wherein the at least one bifurcated fluid channel comprises a different bifurcated fluid channel for each chemical reactant, each different bifurcated fluid channel having a stem and a plurality of branches, the stem of each bifurcated fluid channel being in fluid communication with a respective chemical reactant inlet, and branches of each bifurcated fluid channel being in fluid communication with a mixing and reaction channel.

85. (Previously Presented) The simple plate chemical reactor of Claim 76, wherein the at least one bifurcated fluid channel comprises a bifurcated product collection channel, the stem of the bifurcated product collection channel being in fluid communication with the product outlet, and the branches of said bifurcated product collection channel being in fluid communication with a mixing and reaction channel.

86. (Previously Presented) The simple plate chemical reactor of Claim 76, wherein a bifurcated fluid channel is included for each chemical reactant and one bifurcated fluid channel comprises a bifurcated product collection channel.

87. (Previously Presented) The simple plate chemical reactor of Claim 76, wherein said plurality of heat exchangers comprise:

(a) a first heat exchanger for modifying a temperature of a first chemical reactant;

(b) a second heat exchanger for modifying a temperature of at least one of a second chemical reactant and a mixing and reaction channel;

(c) a third heat exchanger for modifying a temperature of at least one of said mixing and reaction channel and a product collection channel; and

(d) a fourth heat exchanger for modifying a temperature of said product collection channel.

88. (Canceled)

89. (Canceled)

90. (Previously Presented) The simple plate chemical reactor of Claim 76, wherein a widest fluid channel in said parallel array of fluid channels is disposed further to a fluid outlet opening than any other fluid channel in said parallel array.

91. (Original) The simple plate chemical reactor of Claim 90, wherein each chemical reactant is directed into a different parallel array of fluid channels having different widths, each different parallel array of fluid channels being disposed in a different simple plate.

92. (Original) The simple plate chemical reactor of Claim 90, wherein the parallel array of fluid channels having different widths comprises a mixing and reaction channel.

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93. (Canceled)

94. (Previously Presented) The simple plate chemical reactor of Claim 76, further comprising means for providing internal parallelization of said simple plate chemical reactor, to achieve increased throughput.

95. (Original) The simple plate chemical reactor of Claim 94, wherein contiguous sets of the simple plates comprise a plurality of serially-connected reaction units, and wherein said means for providing internal parallelization comprise a plurality of openings in different contiguous sets of the simple plates, which when aligned form, for each one of said serially-connected reaction units:

(a) a reaction unit fluid path in fluid communication with processing volumes in that reaction unit; and

(b) a bypass fluid path that bypasses all processing volumes in that reaction unit, and is in fluid communication with any subsequent reaction unit.

96. (Original) The simple plate chemical reactor of Claim 95, wherein each serially-connected reaction unit comprises:

(a) a first heat exchanger for modifying a temperature of a first chemical reactant;

(b) a second heat exchanger for modifying a temperature of at least one of a second chemical reactant and a mixing and reaction channel, said mixing and reaction channel being operative to:

(i) establish a laminated flow between a first chemical reactant and a second chemical reactant;

(ii) mix the first chemical reactant and the second chemical reactant together via diffusion mixing; and

(iii) provide sufficient residence time for initiating a chemical reaction between the first chemical reactant and the second chemical reactant; and

(c) a third heat exchanger for modifying a temperature of said mixing and reaction channel.

97. (Original) The simple plate chemical reactor of Claim 96, wherein the first heat exchanger of each serially-connected reaction unit disposed downstream of a different serially-connected reaction unit also comprises the third heat exchanger of the reaction unit disposed immediately upstream.

98. (Original) The simple plate chemical reactor of Claim 95, wherein a plurality of said serially-connected reaction units are irreversibly joined together to form a reactor stack.

99. (Original) The simple plate chemical reactor of Claim 98 wherein a plurality of individual reactor stacks are reversibly joined together to form a chemical plant.

Claims 100 - 110 (Canceled)

111. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising:

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(a) a plurality of simple plates, stacked in layers, each simple plate having a plurality of openings that extend therethrough, such that when the plurality of simple plates are stacked in layers to achieve the stacked plate reactor, openings in each simple plate overlap openings in an adjacent simple plate, thereby forming:

(i) a fluid path for each different chemical reactant;

(ii) a fluid path for a chemical product;

(iii) a fluid path for a heat transfer medium;

(iv) a heat exchanger coupled in fluid communication with the fluid path for the heat transfer medium; and

(v) means for manipulating a flow of fluid in said stacked plate reactor to achieve a desired result; and

(b) at least one additional plate having no openings, said at least one additional plate being disposed to seal at least one of a top, a bottom, and a side of the stacked plate reactor.

112. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates, stacked in layers, each simple plate having a plurality of openings that extend therethrough, such that when the plurality of simple plates are stacked in layers to achieve the stacked plate reactor, openings in each simple plate overlap openings in an adjacent simple plate, thereby defining:

(a) a fluid path for each different chemical reactant;

(b) a fluid path for a chemical product;

(c) a fluid path for a heat transfer medium;

(d) a heat exchanger coupled in fluid communication with the fluid path for the heat transfer medium; and

(e) means for providing internal parallelization of fluid flow through the stacked plate reactor, thereby increasing a quantity of chemical product that can be produced by said stacked plate reactor per unit time, such internal parallelization being characterized by achieving at least two parallel fluid flows in different layers of the stacked plate reactor that are not in fluid communication with each other.

113. (Currently Canceled)

114. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates, stacked in layers, each simple plate having a plurality of openings that extend therethrough, such that when the plurality of simple plates are stacked in layers to achieve the stacked plate reactor, openings in each simple plate overlap openings in an adjacent simple plate, thereby defining:

(a) a fluid path for each different chemical reactant;

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(b) a processing volume in fluid communication with each fluid path for each different chemical reactant;

(c) a fluid path for a chemical product in fluid communication with the processing volume;

(d) a fluid path for a heat transfer medium; and

(e) a heat exchanger in fluid communication with the fluid path for the heat transfer medium and disposed so as to moderate a temperature of at least one of a chemical reactant, the processing volume, and the fluid path for the chemical product, the heat exchanger comprising a plurality of heat exchanger fluid channels that extend substantially orthogonal to a plurality of fluid channels for directing a flow of at least one of a chemical reactant and a chemical product, such that the plurality of heat exchanger fluid channels are not in fluid communication with the plurality of fluid channels for directing a flow of at least one of the chemical reactant and the chemical product, and where a temperature of said one of the chemical product and the chemical reactant is modified by heat transfer relative to the heat transfer medium that is flowing through the heat exchanger.

115. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates, stacked in layers, each simple plate having a plurality of openings that extend therethrough, such that when the plurality of simple plates are stacked in layers to achieve the stacked plate reactor, openings in each simple plate overlap openings in an adjacent simple plate, thereby forming:

(a) a fluid path for each different chemical reactant;

(b) a first reaction unit defined by a plurality of openings in the simple plates, said plurality of openings being aligned to form, for each different chemical reactant:

(i) a reaction unit fluid path in fluid communication with a processing volume in said first reaction unit; and

(ii) a bypass fluid path that bypasses the processing volume in the first reaction unit and is in fluid communication with any subsequent reaction unit; and

(c) a last reaction unit defined by the plurality of openings in the simple plate, said plurality of openings being aligned to form, for each different chemical reactant, a reaction unit fluid path in fluid communication with a processing volume in said last reaction unit;

(d) a fluid path for a chemical product in fluid communication with each processing volume;

(e) a fluid path for a heat transfer medium; and

(f) a heat exchanger in fluid communication with the fluid path for the heat transfer medium and disposed so as to moderate a temperature of at least one of a chemical reactant, at least one processing volume, and the fluid path for the chemical product.

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116. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates, stacked in layers, each simple plate having a plurality of openings that extend therethrough, such that when the plurality of simple plates are stacked in layers to achieve the stacked plate reactor, openings in each simple plate overlap openings in an adjacent simple plate, thereby defining:

(a) a single fluid inlet for each chemical reactant;

(b) a reactor fluid path for each chemical reactant, each reactor fluid path being in fluid communication with a processing volume in a first reaction unit;

(c) a bypass fluid path for each chemical reactant, each bypass fluid path bypassing the processing volume in the first reaction unit, and being in fluid communication with any subsequent reaction unit; and

(d) a single fluid outlet for the chemical product.

117. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates, stacked in layers, each simple plate having a plurality of openings that extend therethrough, such that when the plurality of simple plates are stacked in layers to achieve the stacked plate reactor, openings in each simple plate overlap openings in an adjacent simple plate, thereby forming:

(a) a fluid path for each different chemical reactant;

(b) a processing volume in fluid communication with each fluid path for each different chemical reactant;

(c) a fluid path for a chemical product in fluid communication with the processing volume;

(d) a plurality of openings having different widths disposed in at least one simple plate, the different widths being selected to provide a substantially even flow equipartition for a fluid flowing through a plurality of different width fluid channels defined by the plurality of openings having different widths, wherein each of the plurality of openings having different widths are disposed in a parallel array, said openings being ordered so as to decrease in size from a widest opening to a narrowest opening and defining a parallel array of the different width fluid channels;

(e) a fluid path for a heat transfer medium; and

(f) a heat exchanger in fluid communication with the fluid path for the heat transfer medium and disposed so as to moderate a temperature of at least one of a chemical reactant, at least one processing volume, and the fluid path for the chemical product.

118. (Previously Presented) A simple plate chemical reactor for processing at least two reactants to form a desired chemical product, comprising:

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(a) a first outer simple plate and a second outer simple plate, said first and second outer simple plates together including a fluid inlet for each chemical reactant, a product outlet, a fluid inlet for a heat transfer medium, and a fluid outlet for the heat transfer medium; and

(b) a plurality of simple plates disposed between the first and the second outer simple plates, each simple plate having a plurality of openings that extend therethrough, such that when the plurality of simple plates are stacked in layers, openings in each simple plate overlap openings in an adjacent simple plate, thereby forming:

(i) a plurality of heat exchangers for modifying a temperature of at least one of a chemical reactant and a chemical product;

(ii) at least one fluid path for each chemical reactant;

(iii) at least one mixing and reaction channel; and

(iv) at least one bifurcated fluid channel configured to enhance a fluid distribution within the reactor.

119. (Previously Presented) A simple plate chemical reactor for processing at least two reactants to form a desired chemical product, comprising:

(a) a first outer simple plate and a second outer simple plate, said first and second outer simple plates together including a fluid inlet for each chemical reactant, a product outlet, a fluid inlet for a heat transfer medium, and a fluid outlet for the heat transfer medium; and

(b) a plurality of simple plates disposed between the first and the second outer simple plates, each simple plate having a plurality of openings that extend therethrough, such that when the plurality of simple plates are stacked in layers, openings in each simple plate overlap openings in an adjacent simple plate, thereby forming:

(i) a plurality of heat exchangers for modifying a temperature of at least one of a chemical reactant and a chemical product;

(ii) at least one fluid path for each chemical reactant;

(iii) at least one mixing and reaction channel; and

(iv) a plurality of openings having different widths formed in at least one simple plate, said different widths having been selected to provide a substantially even flow equipartition for a fluid flowing in a plurality of fluid channels defined by the plurality of openings having different widths.

120. (Previously Presented) A simple plate chemical reactor for processing at least two reactants to form a desired chemical product, comprising:

(a) a first outer simple plate and a second outer simple plate, said first and second outer simple plates together including a fluid inlet for each chemical reactant, a product outlet, a fluid inlet for a heat transfer medium, and a fluid outlet for the heat transfer medium; and

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(b) a plurality of simple plates disposed between the first and the second outer simple plates, each simple plate having a plurality of openings that extend therethrough, such that when the plurality of simple plates are stacked in layers, openings in each simple plate overlap openings in an adjacent simple plate, thereby forming:

(i) a plurality of heat exchangers for modifying a temperature of at least one of a chemical reactant and a chemical product;

(ii) at least one fluid path for each chemical reactant;

(iii) at least one mixing and reaction channel; and

(iv) a plurality of openings having different lengths formed in at least one simple plate, said different lengths having been selected to provide a substantially even flow equipartition for a fluid flowing in a plurality of fluid channels defined by the plurality of openings having different lengths.

121. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates stacked in layers, each simple plate having a plurality of openings that extend therethrough, openings in each simple plate overlapping openings in an adjacent simple plate, thereby forming:

(a) a fluid path for each different chemical reactant;

(b) a fluid path for a chemical product; and

(c) at least one of:

(i) at least one bifurcated fluid channel configured to enhance a fluid distribution within the reactor;

(ii) a plurality of openings having different widths formed in at least one simple plate, said different widths having been selected to provide a substantially even flow equipartition for a fluid flowing in a plurality of fluid channels defined by the plurality of openings having different widths;

(iii) a plurality of openings having different lengths formed in at least one simple plate, said different lengths having been selected to provide a substantially even flow equipartition for a fluid flowing in a plurality of fluid channels defined by the plurality of openings having different lengths; and

(iv) a plurality of individual reaction units providing internal parallelization of fluid flow through the stacked plate reactor, thereby increasing a quantity of chemical product that can be produced by said stacked plate reactor per unit time, each reaction unit including:

(1) a mixing and reaction chamber;

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(2) a reactant fluid path for each reactant, each reactant fluid path being in fluid communication with said mixing and reaction chamber; and

(3) a bypass fluid path for each reactant, each bypass fluid path being in fluid communication with a different individual reaction unit, such that a reactant flowing in a bypass fluid path in a reaction unit does not also flow into a mixing and reaction chamber in said reaction unit.

122. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor being assembled from a plurality of plates stacked in layers, said stacked plate reactor comprising:

(a) a fluid path for each different chemical reactant;

(b) a fluid path for a chemical product; and

(c) at least one of:

(i) at least one bifurcated fluid channel configured to enhance a fluid distribution within the reactor;

(ii) a plurality of openings having different widths formed in at least one simple plate, said different widths having been selected to provide a substantially even flow equipartition for a fluid flowing in a plurality of fluid channels defined by the plurality of openings having different widths;

(iii) a plurality of openings having different lengths formed in at least one simple plate, said different lengths having been selected to provide a substantially even flow equipartition for a fluid flowing in a plurality of fluid channels defined by the plurality of openings having different lengths; and

(iv) a plurality of individual reaction units providing internal parallelization of fluid flow through the stacked plate reactor, thereby increasing a quantity of chemical product that can be produced by said stacked plate reactor per unit time, each reaction unit including:

(1) a mixing and reaction chamber;

(2) a reactant fluid path for each reactant, each reactant fluid path being in fluid communication with said mixing and reaction chamber; and

(3) a bypass fluid path for each reactant, each bypass fluid path being in fluid communication with a different individual reaction unit, such that a reactant flowing in a bypass fluid path in a reaction unit does not also flow into a mixing and reaction chamber in said reaction unit.

123. (Previously Presented) A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates stacked in layers, each simple plate having a plurality of openings that extend

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therethrough, openings in each simple plate overlapping openings in an adjacent simple plate, thereby forming:

(a) a fluid path for each different chemical reactant;

(b) a fluid path for a chemical product; and

(c) a heat transfer fluid path for a heat transfer medium, such that the heat transfer fluid path and the fluid paths for each different chemical reactant and the chemical product are not in fluid communication;

(d) a heat exchanger coupled in fluid communication with the fluid path for the heat transfer medium; and

(e) means for manipulating a flow of fluid in said stacked plate reactor to achieve a desired result.

a heat transfer fluid path for a heat transfer medium, such that the heat transfer fluid path and the fluid paths for each different chemical reactant and the chemical product are not in fluid communication

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